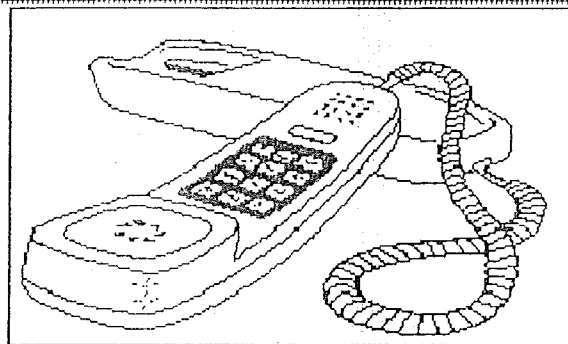


MAESTRO 2400XR MODEM

1200 - 2400 BPS
HAYES COMPATIBLE
AUTO ANSWER - AUTO DIAL



MAESTRO 2400XR "AT" FIRMWARE SPECIFICATION

YOUR NEW MAESTRO MODEM HAS BEEN DESIGNED
AROUND THE LATEST TECHNIQUES IN DIGITAL SIGNAL
PROCESSING RESULTING IN SUPERIOR PERFORMANCE.

WITH THAT IN MIND, CARE SHOULD BE TAKEN WHEN
CHOOSING A POSITION FOR YOUR NEW MODEM.
THE LOCATION SHOULD BE AS FAR AS POSSIBLE FROM
POTENTIAL SOURCES OF R.F. INTERFERENCE,
ie MONITOR OR COMPUTER.

THIS RECOMMENDATION ALSO APPLIES TO THE
POSITIONING OF YOUR TELEPHONE CABLE.

WARNING

UNDER NO CIRCUMSTANCES SHOULD THE USER
ALLOW THE MODEM TO REMAIN CONNECTED TO
THE TELEPHONE LINE WHEN NOT IN USE.

ANY DAMAGE CAUSED TO THE MODEM
BY LIGHTNING STRIKES WILL NOT BE COVERED
UNDER THE TERMS OF THE WARRANTY

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1.0 Introduction

1.1 General Description

This specification describes the firmware driver for the MAESTRO 2400XR modem. The firmware driver will provide "AT" compatibility for the MAESTRO 2400XR. The firmware will be based on the Intel 8051 microcontroller and will be contained in less than 8K of EPROM.

1.2 Connecting to Your Computer

To connect the MAESTRO 2400XR modem to your computer, you will need an additional item not supplied with the modem. This is an RS232 cable to connect the computer to the modem. At the rear of the modem is a female DB25 connector. The only lines required to be connected to the modem are **pins 2, 3 and 7** (TxD, RxD and Ground, respectively). These lines should be connected to your computer using the connector specified for the serial port being used to drive the modem. The possible configurations are many and varied and it is for this reason that a cable is not supplied with the modem (See also Appendix 2).

2.0 Key Features and limitations

2.1 Features

The MAESTRO XR modem with 8051 driver firmware is a full duplex 300/1200/2400 Bits Per Second (BPS) modem designed to work on the switched telephone network. The modem is fully compatible with the CCITT V.22bis, BELL 212A and BELL 103 modem standards. It is also compatible with the V.22 international standards at 1200 BPS. The integral auto-dialler is compatible with the industry standard "AT" command set and is compatible with most popular Personal Computer (PC) software packages.

Features include:

- * CCITT V.22bis compatible
- * Bell 212A compatible
- * Bell 103 compatible
- * CCITT V.22 compatible
- * Industry Standard "AT" dialler compatible
- * User diagnostics
- * NV RAM for configuration and phone number storage

2.2 Limitations

- * Dialler can only handle 10 bit character.
- * ATL - Speaker volume command not implemented
- * Signal Quality (S1) not implemented

3.0 Dialler

3.1 Dialler Format

The Data Terminal Equipment (DTE) communicates with the modem through

a serial data link. Communications can occur at 110, 300, 1200 AND 2400 BPS. The modem will monitor the transmitted data (TXD) and try to frame the incoming data. If an "AT" sequence is detected the modem will autobaud and calculate the format of the data. In order to do this there are some restrictions on the format of the incoming "AT" sequence. The character format of the data must be one of the following:

Data Bits	Parity	Stop Bits	Total Bits
=====			
7	None	2	10
7	Odd	1	10
7	Even	1	10
7	Mark	1	10
7	Space	1	10
8	None	1	10

There is also a restriction on the baud rate of the incoming commands so as to insure reliable autobaud detection. The rates are as follows:

At 110	109 to 111	BPS
At 300	297 to 303	BPS
At 1200	1188 to 1212	BPS
At 2400	2377 to 2224	BPS

3.2 "AT" Command Set

There are four distinct modes of operation for the "AT" compatible dialler. They are:

1. IDLE MODE
2. COMMAND MODE
3. DATA MODE
4. ON-LINE INTERACTIVE MODE

These modes will be described in detailed in the following sections.

3.2.1 IDLE MODE

This mode is entered into when the modem is in the initial power on state. It can also be entered after the modem has executed a command line. In this mode the modem is waiting to autobaud an "AT" sequence from the DTE or awaiting a ring in signal from the phone line. If a valid "AT" is detected the modem enters the COMMAND MODE. If a valid ring-in signal is detected the modem will send a "RING" message to the DTE at the last autobaud speed. If optioned to the answer mode (S0 > 0) then the modem will go off hook and enter the DATA MODE.

3.2.2 COMMAND MODE

After a valid "AT" is detected the modem enters the command mode. Here the modem buffers command characters from the DTE until a carriage return

character is received. The modem will buffer up to 40 characters not including the initial "AT" characters. If more than 40 characters are received the modem will wait for a carriage return character and return an "ERROR" message signifying a buffer overflow. If no overflow is detected and a carriage return character is received the modem will start to execute commands in the buffer. The modem will execute the commands sequentially until one of the following

a. Carriage Return Detected

Result - If dial command - Go look for answer tone
- If not dial - Go back to Idle mode. .

b. Illegal Command Encountered

Result - 1. "ERROR" message sent to DTE
2. Command buffer emptied
3. Returns to IDLE MODE

c. Reset Command Detected (ATZ)

Result - 1. All options set to the default
2. "OK" message sent to DTE
3. Returns to IDLE MODE

d. Answer (A) or On-line (O) command received

Result - 1. Enter DATA MODE

3.2.3. DATA MODE

After an A or O command, Auto answer or Answer tone detect the modem enters data mode. The modem will try to handshake with the far end modem or if already connected will transfer data to and from the far end.

The modem can exit from the DATA MODE to one of three modes as follows:

a. Escape sequence detected (+++)

Result - 1. "OK" message sent to DTE
2. Modem clamps transmit data to mark.
3. Modem disables receive data to DTE
4. goes to ON-LINE INTERACTIVE MODE

b. Loss of Carrier Detected (If S10 < 255)

Result - 1. "NO CARRIER" message sent to DTE
2. Modem goes onhook
3. Returns to IDLE MODE

c. DTR dropped (If DTR not forced on)

Result - 1. "NO CARRIER" message sent to DTE

2. Modem goes onhook
3. Returns to IDLE MODE

d. Long Space Detected (If optioned on)

- Result - 1. "NO CARRIER" message sent to DTE
2. Modem goes onhook
 3. Returns to IDLE MODE

3.2.4 ON-LINE INTERACTIVE MODE

This state is entered after a +++ escape has been detected. The modem link is preserved and the user can now execute interactive commands. The user can now exit to one of the following states:

a. ATH command received

- Result - 1. "OK" message sent DTE
2. Modem goes onhook
 3. Returns to IDLE MODE

b. ATZ command received

- Result - 1. All options set to the default values
2. Modem goes onhook
 3. "OK" message sent to DTE
 4. Returns to IDLE MODE

c. ATO or ATA command received

- Result - 1. "CONNECT" message sent
2. Modem unclamps RXD and TXD data
 3. Returns to DATA MODE

3.3 Dialler Commands

A - Answer

Parameters - None
Default - None

This command initiates the Answer mode. The modem will go offhook and enter DATA MODE. There will be a 2.1 second delay and then the modem will send out answer tone. If no carrier is detected within 87 seconds the modem will go onhook and return to IDLE MODE.

A/ - Re-execute last command

A/ is the only command that does not need to be preceded by an "AT". This command will execute the preceding command strings.

B - Bell / CCITT select

Parameters - 0 or 1

Default -0 (CCITT mode)

This command selects BELL 212A mode or CCITT V.22 mode for the high speed protocol. When BELL mode is selected the modem will connect according to the BELL 212A Specifications. When CCITT mode is selected the modem will handshake according to the CCITT V.22 specifications.

The low speed mode will remain BELL 103 in both CCITT and BELL modes.

D - Dial Command

Dialled Digits 0 1 2 3 4 5 6 7 8 9 # *

Separators - () <SPACE>

Modifiers T P W @ ! R / ; , S

This command starts the Dialling sequence. When the "D" command is detected the modem will go offhook, wait 2 seconds and then start to dial. The modem will dial the 12 standard touch tone digits. These digits may be separated by the separators listed above. Certain modifiers will effect the way the number is dialled these are listed below:

T - Switch to Touch Tone Dialling

P - Switch to Pulse Dialling

W - Wait for dialtone

This modifier will delay dialling until a dialtone is detected. If no dialtone is detected within the S7 time period the call will be aborted.

@ - Wait for Quiet Answer

When this character is detected in a dial string the modem will wait for 5 seconds of silence before continuing to dial. If no silence is seen within the S7 time period the call will be aborted.

! - Hook Flash

This character will cause the modem to go onhook for 1/2 Second. This can be useful in PABX systems.

R - Reverse Answer Mode

When this character is detected the modem will wait 2 seconds and then go into the answer mode. This is equivalent to the ATA command.

S - Dial stored number

/ - Wait 0.125 Seconds

This pause is similar to the comma pause but only waits 1/8 of a second.

; - Return to command mode

This character causes the modem to return to the IDLE MODE after dialling a number. The modem will remain offhook.

, - Pause S8 seconds

This character will cause the modem to wait a period controlled by the S8 register before continuing to dial.

E - Command Echo

Parameters - 0 or 1

Default - 1 (Command Echo Enabled)

This command controls the echoing of command characters. On power up all characters sent to the modem will be echoed. ATEO will disable the echo.

H - Hook command

Parameters - 0, 1 and 2

Default - 0 (Modem on-hook)

Controls the hook relay. ATH1 command the modem to go off-hook. ATHO commands the modem to go on-hook. ATH2 is included for compatibility purposes only and performs no function.

I - Identification Command

Parameters - 0, 1, 2

Default - NA

Outputs an identification code for the modem.

ATI or ATIO - MAESTRO 2400XR sends "240" identification (May change)

ATI1 - MAESTRO 2400XR sends "231" identification (May change)

ATI3 - MAESTRO 2400XR sends "OK" message if ROM checksum verifies, otherwise sends "ERROR" message.

L - Speaker Volume

Default - 2

This command is included for compatibility purposes only and has no effect.

M - Speaker Control

Parameters - 0, 1, 2, or 3

Default - 1 (Speaker on until line carrier detected)

This command controls the operation of the onboard speaker.

ATM or ATMO - Speaker always off

ATM1 - Speaker on until line carrier detected

ATM2 - Speaker always on

ATM3 - Same as ATM1 but DTMF tones are not heard

O - On-line or Originate

Parameters - 0 or 1

Default - 0

ATO

The operation of this command depends on the current mode of the modem. When the modem is in the COMMAND MODE the 0 command will enter the DATA MODE and start the originating handshake at the baud rate of the "AT" command. This command should be preceded by an ATH1 command to put the modem offhook.

When the modem is in the ON-LINE INTERACTIVE MODE the 0 command will return the modem to the DATA MODE.

AT01

When the modem is in the on-line interactive mode the AT01 command will request a retrain sequence from the far end modem. This command is only available when the modem is connected in the V.22bis mode. The retrain sequence used is specified in the CCITT V.22 bis specification.

Q - Result Code Control

Parameters - 0 or 1

Default - 1

This command controls whether response messages are sent to the DTE. ATQ or ATQ0 will enable the result messages

ATQ1 will disable the result messages. The user must allow sufficient time for the command to complete when in this mode.

Sr? -Inquire S register command

Parameters - 0 - 27

Default - 0

This command will return the decimal value currently stored in the selected S register.

Sr=n - Set register command

Parameters **r = 0-27** **n = 0-255**

This command is used to set the value of an S register.

NOTE: These settings are not automatically saved in NV Ram, ie if the Modem is turned off, they will be lost unless you save them with the &W command

V - Verbose or Terse Response codes

Parameters - 0 or 1

Default - 1 (Verbose)

This command controls the format of the result codes. An ATV or ATVO enables numeric (Terse) responses. ATV1 enables verbose or English responses. See Section 3.5 for a list of result codes.

X - Response codes enabled

Parameters - 0-4

Default - 4

This command controls which result codes are enabled. This command can be used to enable or disable certain features of this modem. The following table lists the various response combinations.

ATX0 - Enables result codes 0 - 4

ATX1 - Enables result codes 0 - 5

ATX2 - Enables result codes 0 - 6

ATX3 - Enables result codes 0 - 5, 7

ATX4 - Enables result codes 0 - 8

See Section 3.5 for a list of result codes.

Y - Long Space Disconnect

Parameters - 0 or 1

Default - 0

This feature allows the user to enable or disable the Long Space Disconnect Option.

ATY or ATY0 - Disables long space disconnect

ATY1 - Enable Long Space Disconnect

Z - Modem Reset

Parameters - None

Default - NA

This command resets the modem and restores all default settings to the current settings in NV Ram. If the modem is in the ON-LINE INTERACTIVE MODE this command will terminate the call and put the modem onhook. The modem will return to the IDLE MODE after this command is processed.

&C - Carrier Control

Parameters - 0-1

Default - 0

AT&C0 - EIA Carrier always forced on

AT&C1 - EIA Carrier follows data carrier

&D - DTR Control

Parameters - 0-3

Default - 0

AT&D0 - DTR always on

AT&D1 - Modem goes to command state when DTR goes off

AT&D2 - Modem goes on hook and returns to command state when DTR goes off

AT&D3 - Modem initializes when DTR goes off

&F - Fetch S registers from EPROM.

Parameters - none

Returns the factory settings to the Modem. NOTE: These settings will not be saved in NV Ram. To save the factory settings for the S registers, type AT&F&W <CR>

&G - Guard Tone control

Parameters - 0-2

Default - 0

AT&G0 - No Guard tone

AT&G1 - 550 Hz Guard Tone

AT&G2 - 1800 Hz Guard Tone

&L - Leased Line Select

Parameters - 0-1

Default - 0

AT&L0 - Switched Line Select

AT&L1 - Leased Line Select

&M - Sync/Async Select

Parameters - 0-3

Default - 0

AT&M0 - Async Mode

AT&M1 - Sync Mode 2 (Dial Stored Number)

AT&M3 - Sync Mode 3 (DTR Control of Data/Talk Mode)

&P - Pulse Dial Mode

Parameters - 0-1

Default - 1 (Australian Make/Break Ratio)

AT&P0 - US Make/Break Ratio

AT&P1 - Aust. Make/Break Ratio

&R - RTS / CTS Control

Parameters - 0-1

Default - 0

AT&R0 - CTS Follows RTS

AT&R1 - CTS always on

&S - DSR always on

Parameters - 0-1

Default - 0

AT&S0 - DSR always on

AT&S1 - DSR normal

&T - Test Modes

Parameters - 0-8

Default - 0

AT&T0 - Terminate test in progress

AT&T1 - Initiate local analog loopback

AT&T3 - Initiate digital loopback

AT&T4 - Enable RDLB response

AT&T5 - Disable RDLB response

AT&T6 - Initiate RDLB

AT&T7 - Initiate RDLB with self test

AT&T8 - Initiate ALB with self test

&W - Write S registers into NV RAM

Parameters - none

&X - Transmit clock source

Parameters - 0-2

Default - 0

AT&X0 - Modem clock

AT&X1 - DTE supplies clock

AT&X2 - Slave clock mode

&Z - **Store telephone number in NV RAM** - eg AT&Z1234 <CR>. Your computer must be in 8 data bits. See also S modifier for Dial command to save the telephone number.

3.4 S-Register

SO - Rings to Answer

Default = 0

Range = 0 -255

Establishes the number of rings that the modem must receive before the auto answer sequence is started. Values of 1-255 will enable auto answer. A value of 0 will disable auto answer.

S1 - Ring Count

Default = 0

Range = 0 -255

S1 is a read only register that is incremented every time a ring in signal is received. This register is automatically cleared if no ring is received within an 8 second interval.

S2 - Escape Code Character

Default = 43 Decimal "+"

Range = 0 -255

S2 contains the ASCII decimal value of the escape code character. A value greater than 127 will disable escape code detection. This escape code allows the user to exit the DATA MODE and enter the ON-LINE INTERACTIVE MODE.

S3 - Carriage Return Character

Default = 13 Decimal

Range = 0 -255

S3 Contains the ASCII decimal value of the Carriage return character. This character serves as the command line terminator and is also is the character used as the result code terminator.

S4 - Line Feed Character

Default = 10 Decimal

Range = 0 -255

S4 contains the ASCII decimal value of the Line Feed character. The Line Feed character is output after the Carriage return character if full word results are enabled (ATV1 command).

S5 - Back Space Character

Default = 8 Decimal

Range = 0 -255

S5 contains the ASCII decimal value of the Back Space character. When a character matching the Back space character is received any time during a command entry the following will take place:

A. The Back Space Character is echoed.

B. A Forward Space (20H) is output to the DTE.

C. Another Back Space Character is output to the DTE.

If the user tries to backspace past the first command character (following the "AT") nothing will be echoed.

Since each backspace character received may result in the sending of up to 3 characters to the DTE, care must be taken not to transmit backspaces end to end.

S6 - Wait for Dial Tone

Default = 2 Decimal

Range = 2 -255 seconds

S6 contains the time (in seconds) that the MAESTRO 2400XR will wait before dialling a phone number. This delay allows for the delay in dialtone after going offhook. S6 will be ignored if ATX3 or ATX4 is enabled. If S6 is set to a value less than 2 seconds the MAESTRO 2400XR will ignore the value and wait a minimum of 2 seconds.

S7 - Wait for Carrier after Dial

Default = 30 Decimal

Range = 0 -255 seconds

S7 contains the time (in seconds) that the MAESTRO 2400XR will wait for carrier after dialling is completed. In the answer mode S7 is the amount of time that the modem will wait for a carrier after sending out the answer tone.

Please note that some BBS services answer in 300 Baud as the first tone and in these cases S7 should be set to 60, eg **ATS7=60 <CR>**

S8 - Dial Pause time

Default = 2 Decimal

Range = 0 -255 seconds

S8 contains the time (in seconds) that the MAESTRO 2400XR will wait when a comma is encountered in the dial string. This feature is used to insert a pause during dialling to allow for PABX exchange delays.

S9 - Carrier Detect Response Time

Default = 6 Decimal (600 milliseconds)

Range = 0 -255 1/10 seconds

S9 contains the time (in 1/10 seconds) that the MAESTRO 2400XR will validate an answer tone before continuing with the connect sequence. This allows the user to increase the detect time when noisy lines and non-standard call progress tones cause false carrier detect.

S10 - Loss of Carrier Response Time

Default = 14 Decimal (1.4 seconds)

Range = 0 -255 (1/10 seconds)

S10 establishes the delay between loss of carrier to the time that the MAESTRO 2400XR disconnects. By increasing this time, the modem will become less susceptible to line dropouts. By setting register S10 to 255 the MAESTRO 2400XR will ignore the carrier status and function as if carrier were always present.

S11 - Touch Tone Duration

Default = 95 Decimal (95 milliseconds)

Range = 0 -255 milliseconds

S11 contains the value in milliseconds of the Touch Tone duration and spacing. The default value of 95 will send 95ms of tones and a 95ms space between tones.

S12 - Escape Code Guard Time

Default = 50 Decimal (1 second)

Range = 0 -255 1/50 seconds

S12 contains the value (in 20 millisecond intervals) of the Escape code guard time. The escape code guard time is the amount of time that the modem must see a steady mark before and after the escape code sequence before the sequence is recognized. It is also the maximum amount of time that the escape code characters can be spaced apart.

S13 - Bit Mapped Register

Default = N.A.

Range = 0 -255

S14 - Bit Mapped Register (Stored in NV RAM)

Default = See below

Range = 0 -255

S14 contains a bit map of certain internal status states of the modem. This register is a read only register and writing to this register may cause unpredictable results.

Bit 0 - Not used

Bit 1 - 0 = No Echo (ATE0)
1 = Echo (ATE1)

Bit 2 - 0 = Result Codes enabled (ATQ0)
1 = Result Codes disabled (ATQ1)

Bit 3 - 0 = Numeric Result Codes (ATV0)
1 = Verbose Result Codes (ATV1)

Bit 4 - Always Zero

Bit 5 - 0 = Tone Dialling
1 = Pulse Dialling

Bit 6 - Not Used

Bit 7 - 0 = Answer
1 = Originate

S15 - *Not Used*

Default = N.A.
Range = 0 -255

S16 - Test Register

Default = 0
Range = bit mapped

S16 shows the status of the MAESTRO 2400XR test modes. The tests are invoked with the AT&T commands.

bit 0 - ALB
bit 1 - Reserved
bit 2 - Local Digital Loopback
bit 3 - Remote Digital Loopback
bit 4 - IRT
bit 5 - IRT with self test
bit 6 - ALB with self test
bit 7 - Reserved

S17 - *Not Used*

Default = 0
Range = 0

S18 - Test Timer (Stored in NV RAM)

Default = 0
Range = 0 - 255 seconds

The contents of S18 control the duration of the test modes. When S18 is set to 0, the test timer will be disabled.

S19 - *Not Used*

Default = 0

Range = 0

S20 - *Not Used*

Default = 0

Range = 0

S21 - Bit Mapped Register (Stored in NV RAM)

Default = 0

Range = 0 - 255

S21 contains a bit map of certain internal status states of the modem. This register is a read only register and writing to this register may cause unpredictable results.

Bit 0 - Not Used

Bit 1 - Not Used

Bit 2 - 0 = AT&RO

1 = AT&R1

Bit 3,4 - DTR Status

Bit 4	Bit 3	
0	0	Force DTR
0	1	DTR off goes to command state
1	0	DTR forces off-line when off
1	1	Modem initializes with DTR off

Bit 5 - 0 = AT&C0

1 = AT&C

Bit 6 - 0 = AT&SO

1 = AT&S1

Bit 7 - 0 = Disable long space disconnect

1 = Enable long space disconnect

S22 - Bit Mapped Register (Stored in NV RAM)

Default = 76H

Range = 0-255

S22 contains a bit map of certain internal status states of the modem. This register is a read only register and writing to this register may cause unpredictable results.

Bit 0, 1 - not used

Bit 2, 3 - Speaker control

Bit 3 Bit 2

0	0	Speaker always off
0	0	Speaker on until carrier
1	0	Speaker always on
1	1	Speaker on until CXR but off during dialling

Bit 4, 5, 6 - Result code status

Bit 6	Bit 5	Bit 4	
0	0	0	ATX0
1	0	0	ATX1
1	0	1	ATX2
1	1	0	ATX3
1	1	1	ATX4

Bit 7 - Pulse dial status

0 = AT&PO

1 = AT&P1

S23 - Bit Mapped Register (Stored in NV RAM)

Default = 07

Range = 0 - 255

S23 contains a bit map of certain internal status states of the modem. This register is a read only register and writing to this register may cause unpredictable results.

Bit 0 - 0 = Respond to RDLB request

1 = Ignore RDLB request

Bit 1,2 - Communication rate

Bit 2	Bit 1	Speed
0	0	300
0	1	not used
1	0	1200
1	1	2400

Bit 3 - not used

Bit 4, 5 - Parity status

Bit 5	Bit 4	
0	0	Even parity
0	1	Space parity
1	0	Odd Parity
1	1	Mark parity

Bit 6, 7 - Guard tone select

Bit 7	Bit 6	
0	0	No guard tone
0	1	550 Hz
1	0	1800 Hz
1	1	not used

S24 - *Not Used*

Default = 0

Range = 0

S25 - Delay to DTR (Stored in NV RAM)

Default = 5

Range = 0-255 seconds

S26 - RTS to CTS Delay (Sync mode only)

Default = 1

Range = 0 -255 1/100 seconds

S27 - Bit Mapped Register (Stored in NV RAM)

Default = 40H

Range = 0-255

S27 contains a bit map of certain internal status states of the modem. This register is a read only register and writing to this register may cause unpredictable results.

Bit 0, 1 - Transmission mode

Bit 1	Bit 0	
0	0	Async Mode
0	1	Sync Mode 1
1	0	Sync Mode 2
1	1	Sync Mode 3

Bit 2 - Not Used

Bit 4, 5 - Transmission mode

Bit 4 Bit 3

0	0	AT&X0
0	1	AT&X1
1	0	AT&X2
1	1	AT&X3

Bit 6 - 0 = CCITT V.22

1 = BELL 212

Bit 7 - Not Used

3.5 "AT" Response Codes

This table lists the ASCII verbose result codes along with the terse digit codes.

Result Codes

Digit	Word Code	Description
0	OK	Command Executed without error
1	CONNECT	Modem Connected at 300 or 1200 BPS if X0 enabled Modem Connected at 300 BPS if X1, X2, X3 or X4 enabled
2	RING	Ring-in Detected
3	NO CARRIER	Carrier not detected or carrier lost
4	ERROR	Illegal Command or Buffer overflow
5	CONNECT 1200	Modem Connected at 1200 BPS
6	NO DIALTONE	Dialtone not detected
8	NO ANSWER	Quiet answer not detected
10	CONNECT 2400	Modem connected at 2400 BPS

3.6 Test Modes

The following test modes are available on the MAESTRO 2400XR modem.

Analog Loopback (ALB)

Analog Loopback self test (ALBST)

Remote Digital Loopback (RDLB)

Remote Digital Loopback self test (RDLBST)

Local Digital Loopback (LDLB)

All tests are accessed through ASCII commands.

3.6.1 Analog loopback (ALB)

Analog loopback will test the analog and digital performance of the MAESTRO 2400XR modem except for the external hybrid. Analog loopback is controlled with the AT&T1 command. To enter Analog loopback execute the following command string:

`AT&T1<CR>`

The modem will respond with a "CONNECT" message. All characters received will be echoed back. To exit the test execute a +++ escape and reset the modem with an "AT&T0" command.

3.6.2 Remote Digital Loopback (RDLB)

Remote digital loopback will put the far end modem into a loopback mode. This test will verify the receive and transmit sections of the MAESTRO 2400XR modem, the phone line and the far end modem receiver and transmitter. RDLB is only possible in the high speed mode (BELL 212A and V.22bis). The following procedure should be used to initiate RDLB.

- a. Establish a connection with the far end modem in high speed.
- b. Execute a +++ escape on the MAESTRO 2400XR.
- c. Send an "AT&T6<CR>" to initiate test. If a "CONNECT" message is returned then a successful RDLB has been established. All data sent by the MAESTRO 2400XR will be echoed by the far end modem. If an "ERROR" message is returned then the far end modem is unable to respond to a remote test request.
- d. To exit the RDLB test execute a +++ escape and type an ATZ to terminate the connection or an "AT&T0<CR>" to terminate the remote test without dropping the line.

3.6.3 Local Digital Loopback (LDLB)

Local digital loopback will put the local modem into a loopback mode. This test will verify the receive and transmit sections of the MAESTRO 2400XR modem up to the DTE interface, the phone line and the far end modems transmitter and receiver. The following procedure should be used to initiate Local digital loopback:

- a. Establish a connection with the far end modem.
- b. Execute a +++ escape on the MAESTRO 2400XR.
- c. Send an "AT&T3<CR>" to initiate test. If a "CONNECT" message is returned then a successful LDLB has been established. All data received by the local modem will be looped back to the far end modem.
- d. To exit the LDLB test execute a +++ escape and type an ATZ to

5.2 Firmware

The firmware will be based on the Intel series 8051 microcontroller. All code will reside in less than 8K of EPROM (2764).

5.3 Compatibility

The modem firmware will be compatible with most popular communication programs that use the "AT" dialling protocol. This modem will be tested with the following programs to insure compatibility.

Smartcom Version 2.1

Crosstalk XVI Version 3.6

Procomm Version 3.2

5.4 Internal Fuse

Although there are no user serviceable components inside the MAESTRO 2400XR modem, there is a mains fuse located towards the rear of the board. Users should check this fuse prior to returning the unit for service. Units returned with blown fuses will be charged for repairs at the standard rate. **UNDER NO CIRCUMSTANCES** should any of the other internal components be touched or removed from their sockets. The MAESTRO 2400XR contains a large number of CMOS components which can be easily damaged by static discharge.

APPENDIX 1 LED FUNCTIONS

The front panel of the Maestro 2400XR modem has eight Light Emitting Diodes (LED's), the functions of which are described below.

DTR Data Terminal Ready - This LED follows the RS232 signal from the host computer. When the host is powered up and ready to communicate with the modem, this LED will be lit. If this LED is not active at any time, there is either a fault in the cable, or the host computer does not support this line.

RD Received Data - This LED will flash each time data is transmitted from the modem (either from the modem itself or from the modem via a remote computer) to the host. This LED provides a means of visually confirming that data is present on the phone line.

SD Sent (Transmitted) Data - This LED will flash each time data is sent from the host to the modem.

OFF-HOOK - This LED (normally off) is used to indicate whether the modem is set On-Hook (the default setting ATH0 - LED off) or if it is Off Hook (ATH1 - LED on)

HIGH SPEED - Used to indicate when the modem is operating at 2400 bps full duplex. This LED is normally on, as the Maestro 2400XR powers up

DCD Data Carrier Detect - Used to indicate that a valid carrier is always present. Some computers require that DCD always be enabled and it is for this reason that the DCD line is always asserted (AT&C0). For those whose computers support DCD monitoring (AT&C1), the LED will only come on when a valid carrier is detected.

AUTO-ANSWER - In this mode, the modem will automatically answer the phone when it rings. The number of rings the modem will wait before it answers, is controlled by the S0 register. A setting of 0 (ATS0=0) will turn this feature off. This is the default setting.

MODEM READY - The LED glows when the modem is ready to receive commands or data. It is normally on. It is possible to enable modem test procedures, using the AT&Tn command string (where n is one of the numerical tests available). In the test mode, the MR LED will flash during the process of the test. If for some reason the LED goes out (e.g. a failed test), it will be necessary to cycle power to the modem.

If the SD LED does not flash when keys are being pressed on the host computer, then the TxD and RxD leads may have been reversed.

APPENDIX 2

RS232 PIN DESCRIPTIONS

As described in Section 1.1, the only lines required by the Maestro are the TxD (Pin 2), RxD (Pin 3) and Ground (Pin 7). However, in addition to these lines, the modem also supports the following RS232 lines, if they are required by the host computer or communications package:-

Pin 4	RTS (Request to Send)
Pin 5	CTS (Clear to Send)
Pin 6	DSR (Data Set Ready)
Pin 8	DCD (Data Carrier Detect)
Pin 12	HS (High Speed - connect at 2400)
Pin 15	TxCLK (Transmit Clock)
Pin 17	RxCLK (Receive Clock)
Pin 20	DTR (Data Terminal Ready)
Pin 22	RI (Ring Indicator)
Pin 24	ExtCLK (External Clock)